

REMARKS

Applicant thanks the Examiner for the indication of allowable subject matter in Claim 13 if rewritten to overcome the rejection(s) under 35 U.S.C. 112, first paragraph. Applicant has amended Claim 10 to incorporate the allowable subject matter from claim 13 for the purpose of expediting examination. Applicant does not disclaim the right to claim any broader subject matter in related applications. Claim 13 has been canceled. Claims 11-12 have been amended for consistency with the amendments to Claim 10. Claims 11-12 and 25 have also been amended to address the rejections under 35 U.S.C. 112, first paragraph. New claim 28 has been added, which is an independent claim incorporating the limitations of claim 15 and 17 and supported thereby. Claims 10-12 and 14-28 are now pending in this application and are presented for examination herein.

I. 35 U.S.C. 112, first paragraph Rejections

Claims 11-27 were rejected under 35 U.S.C. 112, first paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as his invention. Applicant has amended Claims 11-13 and 25 to clarify that the “hydrophobing material” is a “hydrophobic material.” In addition, Applicant has amended the Specification and the Abstract accordingly as shown above. Further, Applicant has deleted the term “highly” preceding the “conductive contact layer” in Claim 25. In view of the above, Applicant respectfully requests the rejection of Claims 11-27 under 35 U.S.C. 112, first paragraph be withdrawn.

II. Prior Art Rejections

Claims 10, 11, 14, 15 and 22-27 were rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 6,203,936 to Cisar et al. (Cisar). Claims 17-19 and 21 were rejected under 35 U.S.C. 103(a) as being unpatentable over Cisar. Claims 12, 16, and 20 were rejected under 35 U.S.C. 103(a) as being unpatentable over Cisar in view of EP 1117142 to Gyoten et al. or U.S. Patent No. 6,824,874 to Shah et al.

A. Claim 10

Claim 10 has been amended to clarify that the “hydrophobing material” is a “hydrophobic material” and to incorporate the allowable subject matter of Claim 13.

Accordingly, Claim 13 is in condition for allowance. Dependent claims 11-12 and 14-26 are dependent on allowable Claim 10 and thus incorporate the limitations of Claim 10. As such, dependent claims 11-12 and 14-26 are also in condition for allowance.

B. Claim 27

Claim 27 requires “[a] fuel cell, comprising a membrane-electrode unit; and a bipolar plate electrically contacting the membrane-electrode unit on the electrode side, wherein the bipolar plate is in accordance with claim 10.” Because Claim 10 is in condition for allowance as set forth above, Applicant submits Claim 27 is also in condition for allowance.

C. Claim 28

New Claim 28 has been added, which recites “[a] bipolar plate for fuel cells comprising a layer of a hydrophobic material soluble in a solvent on a surface of the bipolar plate, wherein a thickness of the layer is adjusted to an optimum between a low electrical contact resistance to an adjoining electrode and a high hydrophobicity, and wherein the thickness of the layer ranges from 0.1 nm to 50 nm.” Claim 28 is a new independent claim incorporating the elements of dependent claims 15 and 17. The Examiner had rejected Claim 17 under 35 U.S.C. 103(a) as being unpatentable over Cisar. According to the Examiner at page 3 of the February 25, 2008 Office Action:

These claims [17-19 and 21] differ from Cisar *et al.* by reciting the thickness of the hydrophobic layer. However, because the skilled artisan would be familiar with the effect of thickness on conductivity, mechanical strength and protective function, determining an optimal thickness would be within the skill thereof. Therefore, these claims would be obvious over Cisar *et al.*

At paragraph [0030] of the Substitute Specification, there is provided an example of a bipolar plate treated according to one aspect of the present invention:

2.5 ml of a 6 (% by weight) solution of Teflon®AF 1601-56 from the manufacturer DuPont Fluoroproducts is added into a manufacturer-supplied solvent FC75 in a 500 ml measuring cylinder with a perhalogenated solvent FC77 (manufacturer:3M) to 500 ml and 12 stirred for 12 hours at room temperature using a magnetic stirrer. The solution is then ready for use and is applied to a cleaned and dried bipolar plate made of a nickel-based alloy, provided with a contact coating made of gold, using a sponge by even distribution. Subsequently the layer is dried for 30 minutes at 100° C in the recirculating oven. A layer remains on the bipolar plate with of a thickness of appr. 0.6 nm. (Emphasis added).

Referring to the above process, at paragraph [0031], the Substitute Specification recited that “[b]ipolar plates treated in this way exhibit by comparison with untreated plates a markedly different behavior in relation to water, since water applied to it forms droplets which only adhere slightly to the surface of the bipolar plate and can be blown away with only a slight gas flow.” Similarly, paragraph [0033] of the Substitute Specification (as amended) provides “...because of the small thickness of the hydrophobic layer the contact resistance between the bipolar plate and an adjoining electrode are not or are only very slightly influenced. In this case no accumulation of water can be established on the surface of the bipolar plate... This shows that this water can be reliably discharged from the fuel cell.”

Accordingly, by a layer of hydrophobic material that is “adjusted to an optimum between a low electrical contact resistance to an adjoining electrode and a high hydrophobicity, wherein the thickness of the hydrophobic layer ranges from 0.1 nm to 50 nm,” the claimed invention provides a bipolar plate that can reliably discharge water. Applicant submits Claim 28 is in condition for allowance because (a) Cisar is wholly silent as to any indication that the thickness of a layer of hydrophobic material is a result-effective variable; and (b) a bipolar plate comprising a layer thickness (0.1 nm to 50 nm) provides the unexpected results of an optimum between low contact resistance and high hydrophobicity unrecognized by Cisar or the prior art.

Per MPEP 2144.05, “[a] particular parameter must be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation.” Cisar is wholly silent as to any indication that a thickness of the layer of hydrophobic material is a result-effective variable for “an optimum between a low electrical contact resistance to an adjoining electrode and a high hydrophobicity” as claimed. Accordingly, one skilled in the art, from a reading of Cisar would not have recognized that the thickness of a layer of a hydrophobic material was a result-effective variable to realize a certain balance between electrical contact resistance and hydrophobicity. Thus, per MPEP 2144.05, the determination of a thickness would not have been identified as a result-effective variable and the determination of workable ranges for a thickness of a layer of hydrophobic material cannot be characterized as a parameter for routine experimentation. For this reason alone, Applicant submits that Claim 28 is patentable and nonobvious over Cisar.

In addition, Applicants submit that Claim 28 is in condition for allowance because the claimed thickness of hydrophobic layer (0.1 nm to 50 nm) “adjusted to an optimum between a low electrical contact resistance to an adjoining electrode and a high hydrophobicity” is a critical range that provides unexpected results relative to the prior art, including Cisar. *See* MPEP 2144.05, which recites: “Applicants can rebut a prima facie case of obviousness based on overlapping ranges by showing the criticality of the claimed range. The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . .”

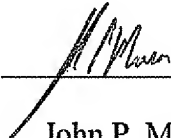
At paragraph [0017], the Substitute Specification (as amended) recites “[t]o simultaneously achieve just a slight effect on the contact resistance between the electrodes and the bipolar plate as well as a good removal of water from the fuel cell, an advantageous embodiment of the invention provides for the thickness of the layer of hydrophobic material to be set to an optimum between a low electrical contact resistance to an adjacent electrode and a high permanent hydrophobicity.” In paragraph [0018], the Substitute Specification (as amended) recites: “[a] low contact resistance and a simultaneous good hydrophobicity of the layer can be achieved by the hydrophobic layer having a thickness in the range of 0.1 nm to 50 nm...” Thus, a bipolar plate comprising a layer thickness (0.1 nm to 50 nm) provides the unexpected results of an optimum between low contact resistance and high hydrophobicity unrecognized by the prior art, including Cisar. Due to the low electrical contact resistance and high hydrophobicity, in turn, when water is applied to the claimed layer of hydrophobic material, the “water forms droplets which only adhere slightly to the surface of the bipolar plate and can be blown away with only a slight gas flow.” *See* paragraph [0031] of the Substitute Specification (as amended). Since Cisar is wholly silent as to the claimed range that provides the above unexpected results, Applicant further submits that new Claim 28 is patentable over Cisar.

III. Conclusion

The commissioner is hereby authorized to charge any appropriate fees due in connection with this paper, including the fees specified in 37 C.F.R. §§ 1.16 (c), 1.17(a)(1) and 1.20(d), or credit any overpayments to Deposit Account No. 19-2179.

Respectfully submitted,

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